

RECEIVED
CENTRAL FAX CENTER

Application No. 10/722,929
Attorney Docket No: 25226A

SEP 08 2006

IN THE CLAIMS

1. (Currently Amended) A method of manufacturing a rigid foam comprising:
 incorporating nano-particles into a polymer melt, said nano-particles being selected from the group consisting of nano-clays, calcium carbonate, intercalated graphites and expanded graphites and having a particle size in at least one dimension less than 100 ;
 incorporating a blowing agent into the polymer melt under a first pressure and at a first temperature;
 extruding the polymer melt under a second pressure and at a second temperature, the second pressure and second temperature being sufficient to allow the polymer melt to expand and form a foam; and
 cooling the foam to form a foam product having an average cell size, said average cell size being greater than approximately 60 μm and having a monomodal-cell size distribution;
wherein said polymer melt includes an alkenyl aromatic polymer material.

2. (Currently Amended) A method of manufacturing a rigid foam according to claim 1, wherein:
wherein the polymer includes a major portion of at least one alkenyl aromatic polymer selected from a group consisting of alkenyl aromatic homopolymers, copolymers of alkenyl aromatic compounds and copolymerizable ethylenically unsaturated comonomers.

3. (Currently Amended) A method of manufacturing a rigid foam according to claim 2, wherein:
wherein the polymer includes a major portion of at least one alkenyl aromatic polymer selected from the group consisting of the polymerization products of styrene, α -methylstyrene, chlorostyrene, bromostyrene, ethylstyrene, vinyl benzene and vinyl toluene; and
 a minor portion of a non-alkenyl aromatic polymer.

4. (Currently Amended) A method of manufacturing a rigid foam according to claim 3, wherein:
wherein the polymer includes at least 80 wt% polystyrene.

5. (Currently Amended) A method of manufacturing a rigid foam according to claim 2;
wherein:

wherein the blowing agent includes at least one composition selected from ~~a group~~
~~consisting of~~ aliphatic hydrocarbons having 1-9 carbon atoms, halogenated aliphatic
hydrocarbons having 1-4 carbon atoms, carbon dioxide, nitrogen, water, azodicarbonamide
and p-toluenesulfonyl.

6. (Currently Amended) A method of manufacturing a rigid foam according to claim 5;
wherein:

wherein the blowing agent includes at least one composition selected from ~~a group~~
~~consisting of~~ methane, methanol, ethane, ethanol, propane, propanol, n-butane, isopentane,
carbon dioxide, nitrogen, water, azodicarbonamide, p-toluenesulfonyl, HCFC-142b and
HCFC-134a.

7. (Original) A method of manufacturing a rigid foam according to claim 2, further
comprising:

incorporating an additive into the polymer melt before forming the foam.

8. (Currently Amended) A method of manufacturing a rigid foam according to claim 7;
wherein:

wherein the additive includes at least one composition selected from ~~a group~~
~~consisting of~~ flame retardants, mold release agents, pigments and fillers.

9. (Currently Amended) A method of manufacturing a rigid foam according to claim 2;
wherein:

wherein the nano-particles have a minimum dimension of less than about 100 nm and
said nano-clays are further selected from the ~~group consisting of~~ intercalated clays and
exfoliated clays.

10. (Currently Amended) A method of manufacturing a rigid foam according to claim 9, wherein:

wherein the nano-particles are incorporated into the polymer melt at a rate of between 0.01 and 10 weight percent, based on polymer weight.

11. (Currently Amended) A method of manufacturing a rigid foam according to claim 9, wherein:

wherein the nano-particles are incorporated into the polymer melt at a rate of between 0.5 and 5 weight percent, based on polymer weight.

12. (Currently Amended) A method of manufacturing a rigid foam according to claim 11, wherein:

wherein the nano-particles include a major portion of nano-Montmorillonite (MMT);
and

the polymer includes a major portion of polystyrene (PS), polyethylene (PE) or polymethyl methacrylate (PMMA).

13. (Currently Amended) A method of manufacturing a rigid foam according to claim 10, wherein:

wherein the nano-particles are formed by a technique selected from a group consisting of intercalation with polystyrene, in-situ polymerization of polystyrene (PS) or polymethyl methacrylate (PMMA) with a surface modified nano-Montmorillonite (MMT), and exfoliation of expandable graphite particles in a polystyrene or polymethyl methacrylate matrix.

14. (Previously Presented) A method of manufacturing a rigid foam according to claim 2, wherein:

the average cell wall thickness is less than about 10 μm ;
the average strut diameter is less than about 20 μm ;
the cell orientation is between about 0.5 and 2.0; and
the foam density is less than about 100 kg/m^3 .

15. (Original) A method of manufacturing a rigid foam according to claim 14, wherein:

the average cell size is between about 60 and about 120 μm ;
the average cell wall thickness is between about 0.2 and about 1.0 μm ;
the average strut diameter is between about 4 and about 8 μm ;
the cell orientation is between about 1.0 and about 1.5; and
the foam density is between about 20 and about 50 kg/m^3 .

16. (Original) A method of manufacturing a rigid foam according to claim 2, further comprising:

incorporating a conventional nucleation agent into the polymer melt at a rate of less than about 2 weight percent based on polymer weight.

17. – 20. (Canceled)

21. (Currently Amended) A method of manufacturing a ~~monomodal~~-rigid foam comprising:

incorporating acicular nano-particles and at least one nucleating agent into a polymer melt, said nano-particles having a particle size in at least one dimension less than 100 ;

adding a blowing agent to said polymer melt under a first pressure and at a first temperature;

extruding said polymer melt under a second pressure and at a second temperature, said second pressure and said second temperature being sufficient to allow said polymer melt to expand and form a foam; and

cooling said foam to form a foam product ~~having a monomodal cell size distribution;~~

wherein said polymer melt includes an alkenyl aromatic polymer material.

22. (Canceled)

23. (Previously Presented) The method of claim 21, wherein said foam has a cell orientation of at least about 1.2.

24. (Currently Amended) A method of manufacturing a rigid foam comprising:
incorporating nano-particles into a polymer melt, said nano-particles being selected from ~~at least one nano-particle selected from~~ calcium carbonate, ~~interealeated~~ intercalated graphites~~[[,]]~~ and expanded graphites;
adding a blowing agent and at least one nano-particle nucleating agent to said polymer melt under a first pressure and at a first temperature, said nano-particles having a particle size in at least one dimension less than 100 ;
extruding said polymer melt under a second pressure and at a second temperature, said second pressure and said second temperature being sufficient to allow said polymer melt to expand and form a foam; and
cooling said foam to form a foam product ~~having an average cell size greater than about 60 μ m;~~
wherein said polymer melt includes an alkenyl aromatic polymer material.